Original Article

Assessing Nurses Knowledge and Practices Regarding Safe Blood Transfusion in a Tertiary Care Hospital of Peshawar

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ABSTRACT

Background: Safe blood transfusion is a critical component of hospital care and depends heavily on the knowledge and clinical competence of nurses involved in patient preparation, bedside verification, monitoring, and early recognition of transfusion reactions. Despite established guidelines, transfusion-related errors remain a preventable source of patient harm. Objective: To assess nurses' knowledge and practices regarding safe blood transfusion in tertiary care hospitals of Peshawar and to examine the association of knowledge level with selected demographic and professional characteristics. Methods: A descriptive cross-sectional study was conducted among 168 bedside nurses recruited through convenience sampling from Rehman Medical Institute, Peshawar Institute of Cardiology, and Northwest General Hospital. Data were collected using a structured adopted questionnaire covering socio-demographic characteristics, knowledge, and practice related to safe blood transfusion. Data were analyzed using SPSS version 25 with descriptive statistics, chi-square tests, and correlation analysis. Results: Of the 168 participants, 55.4% were male and 62.5% were aged 25-29 years. Overall, 29.8% of nurses had low knowledge, 57.7% had moderate knowledge, and 12.5% had high knowledge regarding safe blood transfusion. Knowledge level was not significantly associated with age ($p = 0.276$), gender ($p = 0.966$), or hospital affiliation ($p = 0.908$). However, educational qualification showed a significant association with knowledge level ($p = 0.005$), and higher qualification was positively correlated with better knowledge. Conclusion: Nurses' knowledge regarding safe blood transfusion was predominantly moderate and insufficiently advanced for optimal transfusion safety. Strengthening structured training, competency assessment, and transfusion-related nursing education may improve knowledge and support safer clinical practice. Keywords: blood transfusion, nurses, knowledge, practice, patient safety, tertiary care hospital, Peshawar

INTRODUCTION

Blood transfusion is a vital and frequently used therapeutic intervention in modern health care, playing an essential role in the management of acute blood loss, severe anemia, hematological disorders, surgical emergencies, trauma, and a range of chronic clinical conditions. Although transfusion can be life-saving, it is also associated with important risks, including acute hemolytic reactions, febrile non-hemolytic reactions, allergic responses, septic complications, transfusion-associated circulatory overload, transfusion-related acute lung injury, and transfusion-transmitted infections. A considerable proportion of these adverse events are preventable and arise not from the blood product itself but from failures in the transfusion process, particularly patient misidentification, inadequate bedside verification, poor monitoring, delayed recognition of reactions, and documentation errors (1-4).

Human error has consistently been recognized as one of the leading contributors to transfusion-related incidents worldwide. Hemovigilance reports and clinical safety data have shown that avoidable transfusion errors often occur at the stage of blood collection from the bank, bedside checking, initiation of infusion, and monitoring during and after administration. Because nurses are directly responsible for

most of these steps, they represent the final and one of the most important safety barriers in the transfusion chain. Their ability to correctly identify the patient, verify compatibility, monitor vital signs, recognize early symptoms of transfusion reactions, and respond promptly to complications is central to safe and effective transfusion practice (2,5-7).

Adequate knowledge of blood transfusion principles is therefore essential for high-quality nursing care. Nurses must be familiar with transfusion indications, compatibility requirements, storage and handling precautions, infusion timing, bedside protocols, and the management of acute transfusion reactions. Deficiencies in any of these areas may increase the likelihood of error, compromise patient safety, and negatively affect clinical outcomes. For this reason, contemporary nursing practice emphasizes evidence-based care, ongoing professional education, and competency-based training to ensure that nurses maintain up-to-date knowledge and skills in critical procedures such as blood transfusion administration (8-10).

Despite the availability of international evidence on nurses' transfusion knowledge and practice, findings vary across countries and institutions according to differences in educational preparation, in-service training, hospital policy, workload, and resource availability. In low- and middle-income settings, these contextual factors may be even more influential, making local evidence particularly important for planning targeted educational and patient-safety interventions. In Pakistan, especially in tertiary care hospitals where blood transfusion is commonly performed in complex and high-risk patients, there remains limited recent evidence assessing nurses' knowledge and practices regarding safe blood transfusion. This gap restricts the ability of hospital administrators, nurse educators, and policy planners to design interventions that are responsive to local needs and institutional realities.

The present study was conducted to assess nurses' knowledge and practices regarding safe blood transfusion in tertiary care hospitals of Peshawar. In addition to determining the overall level of knowledge, the study examined its association with selected demographic and professional characteristics, particularly age, gender, hospital affiliation, and educational qualification. It was anticipated that knowledge of safe blood transfusion would not be uniformly adequate across participants and that higher educational preparation would be associated with better knowledge. By identifying existing gaps, the study aims to provide evidence that may support continuing professional development, strengthen transfusion-related competencies, and improve patient safety in hospital settings.

MATERIALS AND METHODS

This study employed a descriptive cross-sectional design to assess nurses' knowledge and practices regarding safe blood transfusion in tertiary care hospitals of Peshawar, Pakistan. A cross-sectional approach was appropriate because the study aimed to measure existing levels of knowledge and reported practice among bedside nurses at a defined period without introducing any intervention. The study was carried out in three tertiary care hospitals, namely Rehman Medical Institute, Peshawar Institute of Cardiology, and Northwest General Hospital. Data collection was completed over a three-month period in 2024 in clinical units where blood transfusion is routinely administered, including general wards and critical care areas.

The study population consisted of bedside nurses working in the selected hospitals. Nurses were eligible for inclusion if they were directly involved in patient management and actively working in wards or units where transfusion-related care could be provided. Nurses serving in administrative or supervisory positions, those not directly involved in bedside care, those on annual or sick leave during the data collection period, novice nurses not yet independently engaged in patient management, and other health-care personnel outside the nursing role were excluded. A convenience sampling technique was used to recruit participants from the three hospitals. The accessible population was 330 nurses, and the

final sample comprised 168 participants. The sample size was determined using a standard sample size calculator with a 95% confidence level and a 5% margin of error.

Data were collected using a structured adopted questionnaire based on a previously reported instrument designed to assess knowledge and practices related to safe blood transfusion (11). The questionnaire consisted of three main sections. The first section recorded socio-demographic and professional information, including hospital, department, age, gender, marital status, educational qualification, and years of experience. The second section assessed participants' knowledge regarding safe blood transfusion, and the third section evaluated their reported practices related to transfusion care. The instrument was administered in a standardized manner across all study sites to maintain uniformity in data collection. Eligible nurses were approached in their respective units, informed about the purpose of the study, and included after providing consent to participate.

The primary outcome variables were knowledge and practice regarding safe blood transfusion. Knowledge was evaluated through questionnaire-based responses and categorized into low, moderate, and high levels according to the scoring framework applied in the study. Practice was assessed using the corresponding practice items in the same instrument. Independent variables included age, gender, hospital affiliation, and educational qualification. To improve consistency and reduce measurement variability, the same questionnaire and data collection procedure were used for all participants in all three hospitals. The study was observational in nature, and no clinical or educational intervention was introduced during data collection.

Several steps were taken to enhance methodological rigor. A structured tool was used for all participants to reduce interviewer variation and ensure comparability of responses. Uniform eligibility criteria were applied across all three hospitals to improve consistency in participant selection. Data were collected only from nurses directly engaged in bedside care in order to ensure relevance to actual transfusion practice. Collected forms were reviewed for completeness before entry, and responses were coded systematically to minimize transcription errors and maintain data integrity.

Data were entered and analyzed using the Statistical Package for the Social Sciences version 25. Descriptive statistics were used to summarize participant characteristics and study variables, including frequencies, percentages, means, standard deviations, medians, and ranges where appropriate. Associations between categorical variables and knowledge levels were examined using chi-square tests. Correlation analyses, including Pearson's and Spearman's coefficients, were performed where appropriate to assess the direction and strength of relationships between coded study variables. A p-value of less than 0.05 was considered statistically significant. Only complete responses were included in the final analysis.

Ethical approval was obtained from the relevant ethical review committee before the commencement of the study, and formal permission for data collection was obtained from the administrations of the participating hospitals. All participants were informed about the purpose of the study, and participation was voluntary. Confidentiality and anonymity were maintained throughout the research process, and the collected information was used solely for academic and research purposes.

RESULTS

A total of 168 nurses were included in the analysis. The mean coded age category was 1.73 ± 0.55, the mean coded hospital category was 1.95 ± 0.89, the mean coded qualification category was 1.57 ± 0.67, and the mean coded knowledge category was 1.83 ± 0.63. There were no missing observations in the final dataset. Male participants constituted 93 of 168 nurses (55.4%), whereas 75 (44.6%) were female. With respect to age, 54 nurses (32.1%) were aged 20-24 years, 105 (62.5%) were aged 25-29 years, and 9 (5.4%) were aged 30-35 years. Hospital-wise, 71 participants (42.3%) were recruited from Rehman Medical Institute, 35 (20.8%) from Peshawar Institute of Cardiology, and 62 (36.9%) from Northwest General

Hospital. Regarding educational preparation, 90 nurses (53.6%) held a BSN qualification, 61 (36.3%) had a diploma in nursing, and 17 (10.1%) had a master's degree in nursing. Overall, knowledge regarding safe blood transfusion was predominantly moderate: 50 nurses (29.8%) had low knowledge, 97 (57.7%) had moderate knowledge, and only 21 (12.5%) demonstrated high knowledge.

Table 1. Sociodemographic and professional characteristics of the participants (n = 168)

Variable	Category	n	%
Gender	Male	93	55.4
	Female	75	44.6
Age group (years)	20-24	54	32.1
	25-29	105	62.5
	30-35	9	5.4
Hospital	Rehman Medical Institute	71	42.3
	Peshawar Institute of Cardiology	35	20.8
	Northwest General Hospital	62	36.9
Qualification	BSN	90	53.6
	Diploma in Nursing	61	36.3
	Master's in Nursing	17	10.1
Knowledge level	Low	50	29.8
	Moderate	97	57.7
	High	21	12.5

Table 1 shows that the study sample was relatively young and professionally early in its likely career stage, with nearly two-thirds of nurses (62.5%) falling in the 25-29-year age group. More than half of the participants were male (55.4%). The largest institutional contribution came from Rehman Medical Institute (42.3%), followed by Northwest General Hospital (36.9%) and Peshawar Institute of Cardiology (20.8%). BSN-qualified nurses formed the largest educational group (53.6%), while only 10.1% had a master's qualification. In terms of the primary outcome, more than four-fifths of participants did not reach the high-knowledge category, as 29.8% had low knowledge and 57.7% had moderate knowledge, leaving only 12.5% with high knowledge regarding safe blood transfusion.

Table 2. Association between gender and knowledge level regarding safe blood transfusion (n = 168)

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	Total	χ^2 (df)	p-value	Effect size
Gender	Male	27 (29.0)	54 (58.1)	12 (12.9)	93	0.068 (2)	0.966	Cramér's V = 0.020
	Female	23 (30.7)	43 (57.3)	9 (12.0)	75			
	Total	50 (29.8)	97 (57.7)	21 (12.5)	168			

Gender was not significantly associated with knowledge level regarding safe blood transfusion. Among male nurses, 29.0% had low knowledge, 58.1% had moderate knowledge, and 12.9% had high knowledge, whereas among female nurses the corresponding proportions were 30.7%, 57.3%, and 12.0%, respectively. The distribution was nearly identical across both groups, and the chi-square test confirmed the absence of a significant association (χ^2 = 0.068, df = 2, p = 0.966). The effect size was negligible, with Cramér's V of 0.020, indicating that gender contributed virtually no meaningful variation in knowledge levels.

Table 3. Association between hospital affiliation and knowledge level regarding safe blood transfusion (n = 168)

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	Total	χ^2 (df)	p-value	Effect size
Hospital	Rehman Medical Institute	22 (31.0)	41 (57.7)	8 (11.3)	71	1.010 (4)	0.908	Cramér's V = 0.055
	Peshawar Institute of Cardiology	9 (25.7)	20 (57.1)	6 (17.1)	35			
	Northwest General Hospital	19 (30.6)	36 (58.1)	7 (11.3)	62			
	Total	50 (29.8)	97 (57.7)	21 (12.5)	168			

Knowledge level did not differ significantly across the three participating hospitals. At Rehman Medical Institute, 31.0% of nurses had low knowledge, 57.7% had moderate knowledge, and 11.3% had high knowledge. At Peshawar Institute of Cardiology, the high-knowledge proportion was somewhat higher at 17.1%, with 25.7% low and 57.1% moderate knowledge, while at Northwest General Hospital the proportions were 30.6%, 58.1%, and 11.3%, respectively. Despite these small numerical differences, the overall association between hospital affiliation and knowledge level was not statistically significant (χ^2 =

1.010, df = 4, p = 0.908). The corresponding Cramér's V of 0.055 indicates a very weak and clinically trivial association.

Table 4. Association between educational qualification and knowledge level regarding safe blood transfusion (n = 168)

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	Total	χ² (df)	p-value	Effect size
Qualification	BSN	28 (31.1)	58 (64.4)	4 (4.4)	90	14.968 (4)	0.005	Cramér's V = 0.211
	Diploma in Nursing	20 (32.8)	29 (47.5)	12 (19.7)	61			
	Master's in nursing	2 (11.8)	10 (58.8)	5 (29.4)	17			
	Total	50 (29.8)	97 (57.7)	21 (12.5)	168			

Educational qualification showed a statistically significant association with knowledge regarding safe blood transfusion. Among BSN-qualified nurses, only 4 of 90 participants (4.4%) were in the high-knowledge category, while 58 (64.4%) had moderate knowledge and 28 (31.1%) had low knowledge. In the diploma group, 12 of 61 nurses (19.7%) demonstrated high knowledge, with 47.5% classified as moderate and 32.8% as low knowledge. The most favorable profile was observed among nurses with a master's qualification, among whom 29.4% achieved high knowledge, 58.8% had moderate knowledge, and only 11.8% had low knowledge. This association was statistically significant (χ² = 14.968, df = 4, p = 0.005), and the effect size was small-to-moderate (Cramér's V = 0.211), indicating that educational attainment contributed meaningfully to differences in transfusion knowledge.

Table 5. Association between age group and knowledge level regarding safe blood transfusion (n = 168)

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	Total	χ² (df)	p-value	Effect size
Age group (years)	20-24	18 (33.3)	28 (51.9)	8 (14.8)	54	5.109 (4)	0.276	Cramér's V = 0.123
	25-29	32 (30.5)	61 (58.1)	12 (11.4)	105			
	30-35	0 (0.0)	8 (88.9)	1 (11.1)	9			
	Total	50 (29.8)	97 (57.7)	21 (12.5)	168			

Age group was not significantly associated with knowledge level. In the 20-24-year group, 33.3% of nurses had low knowledge, 51.9% had moderate knowledge, and 14.8% had high knowledge. Among nurses aged 25-29 years, the respective proportions were 30.5%, 58.1%, and 11.4%. In the 30-35-year group, no participant fell into the low-knowledge category; however, this subgroup was very small (n = 9), with 88.9% categorized as moderate and 11.1% as high knowledge. The chi-square test did not show a significant association between age and knowledge level (χ² = 5.109, df = 4, p = 0.276). The effect size was small (Cramér's V = 0.123), suggesting limited practical influence of age on knowledge distribution in this sample.

Table 6. Correlation analysis for coded participant characteristics and knowledge level (n = 168)

Variable compared with knowledge level	Test	Correlation coefficient (r)	p-value	Interpretation
Gender	Pearson's r	-0.020	0.796	Negligible, non-significant
Gender	Spearman's rho	-0.020	0.796	Negligible, non-significant
Hospital	Pearson's r	0.005	0.951	Negligible, non-significant
Hospital	Spearman's rho	0.006	0.936	Negligible, non-significant
Qualification	Pearson's r	0.204	0.008	Weak positive, significant
Qualification	Spearman's rho	0.175	0.023	Weak positive, significant
Age group	Pearson's r	0.056	0.473	Very weak, non-significant
Age group	Spearman's rho	0.055	0.482	Very weak, non-significant

The correlation analysis supported the categorical findings. Qualification showed a weak but statistically significant positive relationship with knowledge level, with Pearson's r = 0.204 (p = 0.008) and Spearman's rho = 0.175 (p = 0.023), indicating that higher educational attainment tended to be associated with better transfusion knowledge. By contrast, gender, hospital affiliation, and age group showed negligible to very weak correlations with knowledge, all of which were statistically non-significant (p > 0.05). These results reinforce that qualification was the only participant characteristic in this dataset with a meaningful statistical relationship to knowledge regarding safe blood transfusion.
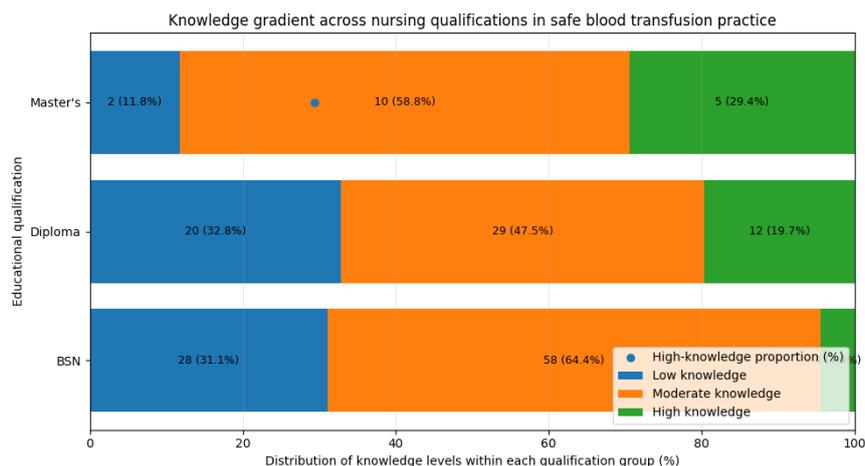
Figure 1 knowledge gradient across nursing qualifications

The figure demonstrates a clear educational gradient in knowledge regarding safe blood transfusion. High knowledge was observed in only 4.4% of BSN nurses, compared with 19.7% of diploma nurses and 29.4% of nurses with a master's qualification. Conversely, low knowledge remained common in both the BSN and diploma groups at 31.1% and 32.8%, respectively, but declined to 11.8% among master's-prepared nurses. Moderate knowledge predominated across all groups, ranging from 47.5% in diploma nurses to 64.4% in BSN nurses. This pattern indicates that while most nurses clustered in the moderate category, advancement in educational qualification was associated with a progressively higher proportion of high knowledge and a lower burden of low knowledge, supporting the statistically significant association identified in the chi-square and correlation analyses.

DISCUSSION

This study assessed nurses' knowledge and practices regarding safe blood transfusion in three tertiary care hospitals of Peshawar and found that overall knowledge was suboptimal, with only 12.5% of participants categorized as having high knowledge, while 57.7% demonstrated moderate knowledge and 29.8% had low knowledge. These findings indicate that although most nurses possessed a basic or intermediate understanding of transfusion safety, a substantial proportion lacked the level of knowledge expected for a high-risk clinical procedure in which errors may lead to serious morbidity or mortality. Given that nurses are directly involved in patient identification, blood product verification, monitoring during transfusion, and early recognition of adverse reactions, this level of knowledge warrants concern from both educational and patient-safety perspectives. The predominance of moderate rather than high knowledge suggests that foundational awareness may be present, but advanced procedural understanding and clinical decision-making related to transfusion safety remain insufficiently developed in a considerable segment of the nursing workforce.

One of the most important findings of this study was the statistically significant association between educational qualification and knowledge level regarding safe blood transfusion. Nurses with a master's qualification showed the most favorable knowledge distribution, with 29.4% falling in the high-knowledge category and only 11.8% in the low-knowledge category. By contrast, BSN-qualified nurses had the lowest proportion of high knowledge at 4.4%, while diploma nurses demonstrated an intermediate pattern, with 19.7% showing high knowledge. The positive correlation between qualification and knowledge level further supports the interpretation that academic preparation contributes meaningfully to nurses' ability to understand and apply transfusion safety principles. This finding is clinically important because it suggests that educational exposure, depth of theoretical preparation, and perhaps engagement with evidence-based practice may influence competency in transfusion-related care. It also implies that hospitals cannot assume uniform knowledge across staff

solely on the basis of professional designation and should instead prioritize competency-based assessment and targeted continuing education.

In contrast, age, gender, and hospital affiliation were not significantly associated with knowledge level. The absence of a significant relationship with age suggests that knowledge of transfusion safety in this sample was not simply a function of maturity or age category. Likewise, the lack of association with gender indicates that transfusion knowledge is not inherently differentiated by sex but is more likely shaped by educational and institutional learning experiences. Similarly, although slight numerical differences were observed across hospitals, these variations were not statistically meaningful, which may indicate a broadly similar pattern of transfusion-related knowledge across the participating institutions. This consistency across hospitals may reflect shared training limitations, comparable clinical practices, or the absence of sufficiently differentiated institutional educational systems related to transfusion safety.

The current findings are broadly consistent with earlier literature showing that nurses often possess only moderate knowledge of blood transfusion procedures and that important gaps may persist in recognizing transfusion reactions, bedside verification requirements, and monitoring responsibilities. Previous studies have also emphasized that clinical knowledge in high-risk nursing procedures is strengthened by structured educational preparation, recent training exposure, and regular reinforcement through workplace-based competency assessment (12-15). The finding that higher educational qualification was associated with better knowledge aligns with research showing that nurses with greater academic preparation may demonstrate stronger theoretical grounding and better adherence to evidence-based clinical standards. At the same time, the relatively low proportion of highly knowledgeable BSN nurses in the present study suggests that possession of a degree alone may not be sufficient and that curriculum content, quality of instruction, clinical supervision, and institutional reinforcement all remain important.

Another important implication of this study is the likely need for more systematic in-service education in transfusion safety. Even where moderate knowledge is common, practice errors may still occur if nurses are uncertain about protocol details, reaction recognition, or immediate emergency responses during administration. Safe transfusion practice requires not only knowledge recall but also consistent procedural accuracy under real clinical conditions. This reinforces the need for training models that go beyond passive information delivery and include demonstration, simulation, bedside reinforcement, transfusion checklists, and periodic reassessment of competency. Such interventions may be especially useful in tertiary care hospitals, where transfusions are more frequent and the consequences of error may be more severe because of patient complexity and acuity (16,17).

The findings should also be interpreted in light of the study's methodological characteristics. The use of a descriptive cross-sectional design allowed for the estimation of current knowledge levels and their associations with selected participant characteristics, but it does not permit causal inference. The convenience sampling technique may limit generalizability, as the sample may not fully represent all nurses working in tertiary care hospitals in Peshawar or other regions of Pakistan. In addition, the study relied on a structured questionnaire, which is suitable for measuring reported knowledge and practice but may not fully capture actual bedside performance. Observational assessment, objective structured competency testing, or mixed-method evaluation may provide a more comprehensive understanding of transfusion-related competence in future studies. Nevertheless, the inclusion of nurses from three tertiary hospitals and the use of a consistent data collection approach strengthen the practical relevance of the findings.

From a policy and practice perspective, the study provides a useful basis for institutional quality improvement. Regular transfusion-safety workshops, competency-based assessments, orientation modules for newly recruited nurses, refresher programs for existing staff, and stronger integration of transfusion content into undergraduate and postgraduate nursing curricula may all help to address the

identified gaps. In addition, nurse managers and hospital administrators should consider reinforcing standard operating procedures through audit, supervision, and case-based learning linked to real transfusion incidents. Future research should expand to larger and more diverse hospital samples, include direct measures of practice, and examine whether educational interventions can improve both knowledge retention and patient-safety outcomes over time. Taken together, the present findings highlight that although basic awareness of safe blood transfusion exists among many nurses, there remains a clear need to strengthen higher-level competency, especially through educational and professional development strategies.

CONCLUSION

This study found that nurses' knowledge regarding safe blood transfusion in tertiary care hospitals of Peshawar was predominantly moderate, with only a small proportion demonstrating high knowledge, indicating that important educational gaps remain in an area of critical patient safety. Educational qualification was the only participant characteristic significantly associated with knowledge level, with better knowledge observed among more highly qualified nurses, whereas age, gender, and hospital affiliation showed no significant relationship. These findings support the need for structured and continuous transfusion-safety education, competency-based in-service training, and stronger curricular emphasis on blood transfusion practice in order to improve nursing performance and reduce transfusion-related risk in hospital settings.

REFERENCES

1. Sadani DT, Urbaniak SJ, Bruce M, Tighe JE. Repeat ABO-incompatible platelet transfusions leading to haemolytic transfusion reaction. Transfus Med. 2006;16(5):375-9.

2. Bolton-Maggs PHB. Serious hazards of transfusion: celebration of 20 years of UK haemovigilance. Transfus Med. 2017;27(6):393-400.

3. Carson JL, Grossman BJ, Kleinman S. Red blood cell transfusion: a clinical practice guideline from the AABB. Ann Intern Med. 2012;157(1):49-58.

4. World Health Organization. Blood safety and availability [Internet]. Geneva: World Health Organization; 2017 [cited 2026 Mar 26]. Available from: http://www.who.int/mediacentre/factsheets/fs279/en/

5. World Health Organization. Screening donated blood for transfusion-transmissible infections [Internet]. Geneva: World Health Organization; 2010 [cited 2026 Mar 26]. Available from: http://www.who.int/bloodsafety/ScreeningDonatedBloodforTransfusion.pdf

6. Stainsby D, Jones H, Asher D. Serious hazards of transfusion: a decade of hemovigilance in the UK. Transfus Med Rev. 2006;20(4):273-82.

7. Bolton-Maggs PHB. SHOT conference report 2016: serious hazards of transfusion - human factors continue to cause most transfusion-related incidents. Transfus Med. 2016;26(6):401-5.

8. Gray A, Hart M, Dalrymple K, Davies T. Promoting safe transfusion practice: right blood, right patient, right time. Br J Nurs. 2008;17(13):812-7.

9. Hsieh PL, Chen SH, Chang LC. School nurses' perceptions, knowledge, and related factors associated with evidence-based practice in Taiwan. Int J Environ Res Public Health. 2018;15(9):1845.

10. Pavenski K, Stanworth S, Fung M, Wood EM, Pink J, Murphy MF, et al. Quality of evidence-based guidelines for transfusion of red blood cells and plasma: a systematic review. Transfus Med Rev. 2018;32(3):135-43.

11. Encan B, Akin S. Knowledge of blood transfusion among nurses: a questionnaire-based study in a tertiary care setting. [adopted tool reference as cited in source manuscript].

12. International Journal of Research in Medical Sciences. Knowledge and practices regarding blood transfusion among nurses in a tertiary care teaching hospital. Int J Res Med Sci. 2017;5(10):4285.

13. Tarhan M, Hancer O, Polat F, Akbas Gokduman S, Dalar L. Noninvasive mechanical ventilation knowledge level of the nurses: a questionnaire survey in a tertiary care training and research hospital. Eurasian J Pulmonol. 2015.

14. Yaseen RW, Salameh TN. Saudi critical care nurses' knowledge of and barriers toward adherence to prevention of ventilator-associated pneumonia guidelines. 4(2):65-69.

15. Abbas MB, Al-Jubouri J. Assessment of nurses' knowledge about nosocomial infection at hospitals in Baghdad City. J Kufa Nurs Sci. 2014;4.

16. Accardi R, Castaldi S, Marzullo A, Ronchi S, Laquintana D, Lusignani M. Prevention of healthcare-associated infections: a descriptive study. Ann Ig. 2017;29(2):101-15.

17. Assefa J, Diress G, Adane S. Infection prevention knowledge, practice, and associated factors among healthcare providers in primary healthcare units of Wogdie District, Northeast Ethiopia: a cross-sectional study. Antimicrob Resist Infect Control. 2020;9(1).

18. Barry M, Alhadlaq G, Alsergani R, Almana R, Alshabib N, Altheeb N. Knowledge and attitudes toward preventing hospital-acquired infections among nurses and residents at a university hospital. J Nat Sci Med. 2020;0(0):0.

19. Bayleyegn B, Mehari A, Damtie D, Negash M. Knowledge, attitude and practice on hospital-acquired infection prevention and associated factors among healthcare workers at University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. Infect Drug Resist. 2021;14:259-66.

20. Brosio F, Kuhdari P, Stefanati A, Sulcaj N, Lupi S, Guidi E, et al. Knowledge and behaviour of nursing students on the prevention of healthcare-associated infections. J Prev Med Hyg. 2017;58.

21. Carvalho TP, Okuno MFP, Campanharo CRV, Lopes MCBT, Batista REA. Patients' knowledge about medication prescription in the emergency service. Rev Bras Enferm. 2018;71(2):329-35.

22. Carvalho TP, Okuno MFP, Campanharo CRV, Lopes MCBT, Batista REA. Patients' knowledge about medication prescription in the emergency service. Rev Bras Enferm. 2018;71(2):329-35.